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THE PHYSICIAN OF THE FUTURE.*

THE day which marks the beginning of a career is always one of interest. Especially is this so for him whose career begins, if indeed a career can be said to have definite commencement. But little less of interest, however, is felt also by his friends, and the day partakes of the nature of an inauguration or a marriage. It is a general day of rejoicing. The graduate himself is happy in the thought that his labors, at least for the time being, are over; his friends are glad to see the honor which he has earned, and the general public takes almost the same interest in the graduate that it does in the lover.

This particular occasion, when those who have completed the prescribed course of medical and dental science present themselves to receive their degrees, is of especial interest. This probably marks the last commencement of the medical and dental school of old Columbian. More than three quarters of a century of achievement marks her successful career. Thousands of graduates scattered throughout the land are proud of the alma mater who started them in life. The change of name, therefore, to George Washington University is not looked upon with unmixed joy, especially by the older children. A mother is, perhaps, no less a mother because, when widowed, she marries another man and takes another name. The academic mother

* Address delivered before the graduating class of the medical and dental schools of Columbian (George Washington) University, Monday, May 30, 1904.

of this widely scattered and numerous family need be no less loved, no less cherished and no less helpful than under her old name.

There are some of the arts which are nearer to the welfare of man than others, and the same is true of the sciences. There are two arts, however, which lie very near human welfare and if we were called upon to give up all of the arts but two, I think there would be little difference in choice as to which two should be preserved. The one most important would be the art of agriculture and the next the art of healing. Man first of all must be nourished and next to this, kept in health.

We might look forward to a time when lawyers would disappear. We might even grow so perfect as to be able to do without ministers of the gospel. Even the histrionic art might be abandoned, and yet mankind be reasonably happy. But strike down agriculture and you strike a blow which is fatal; banish the healing art and you leave man to the ravages of disease. It is, therefore, probably not without some fitness that you have asked a 'farmer' to deliver this address, and it is quite becoming that on this occasion Ceres and Hygeia should be seen hand in hand.

The man who receives his degree believes he knows something and the public supposes that his belief is well founded. The amount known, however, or supposed to be known, varies greatly for different degrees. The college graduate, it has been said, doubtless supposes that he knows all things from *A* to *Z*, but the faculty and trustees, with a better idea of his accomplishments, give him only the degree *A.B.* If I remember aright my Roman numerals an *M.D.* should know at least 1,500 times more than an *A.B.* Yet without doubt the degree *M.D.* or *D.D.S.* should carry a greater ballast of knowledge than the first degrees of the academy. We may, with reason, doubt the propriety of conferring the degree of 'doctor' even upon those who have accomplished as much as you young men who are now before me. *Doctor* signifies 'knowing,' 'learned.' The physician should not—and perhaps no one should—bear this degree who has not added something to the sum of human knowledge. Some of the most famous surgeons and physicians of England are only plain 'mister' and I fail to see where there would be any diminution in your skill if the degree which you receive to-night were 'bachelor' instead of 'doctor.' I am not quarreling, however, with the usual custom, but mention this matter only to show you that bearing this degree you assume a responsibility of which you must strive to be worthy. The doctor is the teacher, the learned man, the *knower* as well as the *doer*. He is the man to whom people must come for knowledge, advice and inspiration. He is, moreover, the *dux*, the *imperator* in the empire of knowledge. Like the thirsting Omar Khayyam, each one should be able to say, 'Myself when young did eagerly frequent doctor and saint and heard great argument,' but the doctors and saints should be of better quality than in those medieval days, for in the present day we should not be compelled to add, 'About it and about but evermore, came out by the same door as in I went.'

Health comes largely from good food and good hygiene, but one of the necessities to health is good mastication. Teeth are useful for other purposes than merely to improve looks, but even if they were only for this purpose they would be worth saving. Many a man has married a beautiful set of teeth and, perhaps, afterwards discovered, to his amazement, that they were the fruit of dental science, but

you young men who have studied dentistry and have become proficient in the art should think the making of teeth to be the least of the purposes of your future life. As in surgery, dentistry is conservative, and you will serve man best if you will enable him to keep the teeth which nature has provided. The physician of the future as well as the dentist must be the arbiter of good health, and good health comes largely from good food and good hygiene; good food well masticated and good hygiene well applied.

The farmer furnishes the food, the dentist secures its mastication, and the physician formulates the laws of health and helps to restore to the normal any diseased organ of the body. The first thing, therefore, which the physician of the future must see to is the food supply, not that he is expected to till the soil and produce its fruits, but that he is to help in the great work of restoring foods to their normal state.

To what lengths have the arts of adulteration gone? There is no time to-night to preach to you about the awful evils of food adulteration, not only of its effect upon health, but of its demoralizing effect upon the honesty of commerce. It is a matter of which the medical profession of this country may be proud, namely, that as a unit they stand committed to the cause of pure food, to opposition to fake advertising, to the restoration of honesty in the trade in food products, and to the elimination from foods of drugs which are useful only in cases of disease. The great army of dentists also in this country stand in the same rank. They are aware, in fact, that if the functions of an organ are suspended the organ itself sooner or later suffers atrophy, loses its power of functional activity, becomes abortive in the course of ages and rudimentary. Thus the great professions of medicine and dentistry in the future will stand together to fight the evils of predigested and prechewed foods. Predigested food will cause the stomach to shrivel and become finally only a rudimental organ. Prechewed food will in the course of ages produce a toothless race. It is bad enough to lose one's hair, but for heaven's sake let us keep our teeth!

I do not care who makes the laws in this country if you will let me furnish the people with good teeth, nor who writes the songs if I can help to keep the stomachs in prime condition. It will be a sad day for humanity in the future when pepsin loses its savor and is furnished only by the chemist and not by the secretory glands of the stomach. See to it then that future generations have something to chew and something to digest, and to this great end much of the energy and ardor of the investigations of our future physicians and dentists must be directed.

The physician of early ages was a magician and necromancer. The medicine man of savage tribes is still practising the art of incantation. It is a far cry to Æsculapius, but before his day even disease was supposed to be the work of evil spirits. In fact the most destructive swine plague that we read about in the Bible was caused by the devils which were cast out of sick men, and these devils, taking possession of the swine, caused them to rush into the sea and be drowned.

The age of magicians in medicine was followed by that of the empiric, which was a great advance and led to the foundations of real science in medicine. The empiric we still have with us and always will have as long as man has idiosyncrasies. We can never tell in any individual case what the result of any certain treatment will be because we can never properly estimate the value of the individual idiosyncrasy.

Empiricism is one of the legitimate aids to science. A great inventor like Edison who wishes to find a certain property tries in logical sequence everything that is practicable, and often it is only after thousands of trials that the substance having the requisite quality is found. So empiricism in medicine is legitimately applicable when guided by scientific reasoning and sound principles.

The age of empiricism, however, was followed by the age of rationalism in medicine and it is on this basis that the science of medicine stands to-day. Perhaps I should not say science of medicine, but the art of medicine, because the art of medicine itself is based upon certain sciences, for instance, the science of anatomy, of physiology, of materia medica, of surgery. In fact there is not a science known to man which may not have some connection with the art of medicine.

If we look at the physicians of the present we find three classes have been founded as a result of rationalism in medicine: First, the general practitioner who of necessity must be brought in contact with all forms of human ills; second, the specialist who happily lives in a community where the physician who devotes his whole time to one particular study can be supported; third, the health officer who is the forerunner of the physician of the future.

The foes of rational medicine at the present time are, first, the quack, a man possessing, possibly, high medical training and skill, but unfortunately devoid of those principles of ethics without which the honorable practise of a profession is impossible; second, the charlatan, a man necessarily devoid of any medical training or ability, who plays upon the feelings of his patients and administers nostrums of no value and applied with no science. The third foe of rational medicine is the impersonal physician, namely, the nostrum, the patent medicine and the proprietary remedy. It is appalling to think of the thousands and thousands of our fellow citizens who pin their faith to these alleged remedies. Some of them have value; they are in fact often the very remedies which are described in the materia medica and the pharmacopœia and administered by physicians, but distributed as they are, with absurd claims of efficiency, taken as they are, without the advice or consent of a physician, they become not only one of the greatest foes of rational medicine, but one of the greatest dangers to the public at large.

I do not deny to the inventor who discovers a new remedy or a new combination of remedies the same right to profit therefrom which is accorded to the inventor of a new machine or a new process. The law protects the inventor of such a remedy and he can protect it by patent or by trademark, but it seems to me there is no excuse for the secret nostrums and no justification for the methods of advertising them. I know how difficult this problem is; I know what vast returns are received by the public press for advertising these bodies; I know how valuable the press is and I appreciate the great and good work which it does, but there is no justification for using the columns of the public press to deceive the public, to excite fears of dangers that do not exist and create hopes that can never be realized.

The physician of the future will see a growing preponderance of preventive medicine and the character of the profession in future years will be largely molded by the influence which this growth exerts.

The activity of preventive medicine will be shown first in the case of public and domestic hygiene. The laws of good living are fairly well known to but few people.

The public schools will surely become a medium of transmitting instruction in this line. Public sanitation in the course of its career may reach that abomination of contrivances in so far as offended hygienic conditions are concerned, namely, the sleeping car. It is difficult to imagine any contrivance which human ingenuity could construct better calculated to secure the best conditions for disease and the best methods for propagation thereof than the sleeping car. Constructed in such a way that ventilation is practically impossible; partitioned into small compartments, carefully curtained to prevent any circulation of air, if there should be fresh air; provided with enough heating surface to the cubic yard to complete the installation of a Turkish bath, and manned by porters to whom high temperature is an evidence of heavenly bliss, it is not difficult to conceive of the tortures to which the helpless passenger is exposed. These compartments often carry, without any precautionary inspection, persons in all stages of phthisis and even other contagious diseases. There is no health officer to inspect incoming passengers, no provision of the law requiring complete fumigation and no systematic appliance of any kind to prevent or eradicate disease. It has been claimed that the blankets are *washed at least twice a year*, as if that alone were a sufficient excuse for all of the dangers that exist! Perhaps, if one used the same blanket himself all the time he might not be justified in objecting to such frequent ablutions, but what right have we to ask if such a *careful* purification of a blanket used by a different person every night is based on any of the broad principles of hygiene or good taste?

The composition of the air in a sleeper filled with passengers, after a night of low temperature can better be imagined than described. It is true that no one is compelled to spend the night in these compartments, but the ordinary coaches are not much less objectionable, and thus the traveler is left only with the option of staying at home or walking to his destination.

The physician of the future will gradually teach the people the principles and necessity of public and private sanitation, for domestic hygiene is no less important than public. That dread scourge of humanity, consumption, will find its most effective foe in the establishment of true principles of hygiene both at home and in public places.

The medical profession of the future will also see extended and placed upon sounder scientific foundations the antitoxin theory of prevention and cure. The world owes a debt of gratitude to Pasteur and his co-laborers in this and other countries for establishing the foundation, on broad scientific grounds, of the idea that immunity may be artificially, as well as naturally, produced. Jenner was the forerunner of this great school of medicine, but his practise was absolutely empirical. Neither he nor his followers had any idea whatever of the manner in which vaccination renders the subject practically immune to smallpox. Advanced medical science has revealed the fact, however, that not only smallpox, but many other deadly diseases owe their toxic development to the compounds produced in the system chemically allied with the nitrogenous constituents of the body. The moment these poisons become dominant in the system nature makes an effort to eliminate them or to neutralize them. In other words, the toxic body is met and combated by the antitoxic body. One of the greatest triumphs of the science of chemistry has been the determination of the character both of toxic and of antitoxic substances and the development

of the method of producing them both, especially the antidote. You have been fully instructed in the principles of this modern branch of medicine and know how closely your future professional activity will be connected therewith.

Perhaps it is not wise to prophesy a time when enzymic diseases shall lose all their terror by reason of the discovery of effective antidotes to the poisons to which their ravages are generally due. It is reasonable, however, to look forward to the time when the terror of these diseases, namely, diphtheria, typhoid fever, typhus and kindred scourges shall be reduced to a minimum.

If, as has been well demonstrated, the germ of typhoid fever is transmitted principally in water, there seems no reason to doubt the ability of health officers, collaborating with broad-minded municipal authority and high class engineering skill, to perfect means whereby this deadly germ shall be practically eliminated from our water supply. Consumption may be checked by the establishment of camps of detention where the unfortunate victims of this terrible disease may receive not only the highest degree of proficiency in medical treatment, but also be so segregated from the non-infected portions of the community as to render the spread of the disease difficult.

Moses himself was a sanitarian of no mean accomplishments and many of the principles established by him in sanitary science might well be exploited in modern times. The type of camp which he established for the detention of unfortunate lepers, well modified to suit modern principles, would serve for the check and practical elimination of consumption.

I realize vividly the effect of a mental nature produced upon people of highly sensitive constitutions and of an impressionable nature, such as the victims of phthisis usually are, in being made practically prisoners in an environment of misery and despair. This, however, is not a question of sentiment, it is a principle of existence. It is based upon the undoubted right of the healthy to be protected against the invasion of disease. Moreover, a detention camp might be made attractive in every way with beautiful gardens, sunshine, flowers, music and all the other agreeable arts of life, and thus the terrors of detention be robbed of their chief significance.

The physician of the future will, therefore, be the herald and exponent of prophylaxis. It seems a contradiction of terms to predict a future for a learned profession, which, if perfected, would rob the profession of all of its emoluments; but with the changed condition of the future physician a change in the character of his emoluments will also come. The medical profession, in other words, will not be paid in proportion to the amount of sickness which prevails, but rather in proportion to the degree of health which is maintained. That physician will have the largest compensation whose parish is freest from disease. He will become the teacher of the principles of public hygiene, as before mentioned, in the schools, colleges and hospitals; he will, in my opinion, become largely a public officer, and every state, city and town will have as one of its chief officials a medical health officer. Surely such an officer is quite as important to the welfare of the community as the assessor and tax collector. The physician of the future, therefore, will become more and more active as a citizen and take a more lively interest in public affairs.

I have looked carefully over the congressional directory of the Fifty-Seventh Congress and find that the congress of the

United States contains 319 lawyers, 93 business men, 32 politicians, 12 editors, reporters and newspaper writers, 8 farmers, 3 teachers, 1 clergyman, 1 military man and 3 physicians. Does it not seem strange that the great law-making body of our country should contain so few members of this learned profession? Think for a moment of the amount of legislation in which sanitary matters are involved! It is acknowledged by all that the building of the Panama Canal is more a sanitary problem than it is an engineering one. The men who really build the Panama Canal will be the physicians and health officers who eliminate from that infected locality the germs of malaria and infectious diseases. If the canal fails it will not be for lack of dredges nor shovels nor picks nor machinery nor money; it will be due to the ravages of cholera, of yellow fever and of other malarial diseases.

The importance of the quarantine service has not been fully recognized. The exclusion of disease is the easiest way to fight it. The splendid work of the Public Health and Marine Hospital Service is one of the things which the national legislator should carefully support.

The legislation relating to pure food is a matter of the utmost sanitary importance. The regulations of interstate commerce which omit the sanitary conditions which have been previously outlined are altogether incomplete. In fact it appears that a very large proportion of our legislation which really concerns the public welfare should be accomplished with the advice, the vote and consent of the medical profession, and yet out of more than 400 members of the national congress only three have had any medical training. The congress of the future will contain not less than 1 per cent. of trained medical men, but let us hope as much as 25 or 30 per cent. Again, there is no reason why a medical training should unfit a man for other duties in connection with public life than those relating to sanitary measures. I can see no reason why a physician should not make a good president as well as a good major general, a good governor or a good mayor, a good member of the common council and especially a most excellent commissioner of sewers. We wish the future to see the entry of medical men into public life and the assumption by them of all duties of a nature which relate to the public welfare. I can see no reason why lawyers should predominate in our national congress any more than that physicians should hold the balance of power. Perhaps I can not better illustrate this idea than by quoting from that master of political craft, that learned and erudite statesman, ex-Senator David Turpie, who says in his book, entitled 'Recollections of My Own Times,' in speaking of Senator Dr. Graham N. Fitch:

> Fitch was the only physician who ever served from Indiana in the United States Senate. I have latterly reflected somewhat upon this solitary instance. Years ago we used to send a good many of our physicians to Congress. He, himself, was one of these, and there were several others, among whom I recall Dr. John W. Davis, of Carlisle, in the county of Sullivan, whom I knew quite well. He was the first Indianian chosen to the position of speaker of the House at Washington and was accounted the best parliamentary jurist in the country, perhaps in the world. His rulings were quoted as authority in the English House of Commons and more than once in the legislative chambers of France. Upon his voluntary retirement from Congress he was appointed minister of the United States to China; served with distinction among the polished diplomats of the Orient, and returned to accept the appointment of governor of Oregon. He was the first American civilian of official note and station to make the trip homeward from the east by way of the Pacific. His voyage across the ocean lasted several weeks. I have heard that the account of it, then no twice-told tale, was a story of thrilling, almost tragic interest.

In these later times our practitioners of the healing art seem studiously to avoid the cares and labors of political life. Occasionally you may meet a physician in the legislature—even this, as some of their caste say, is unprofessional—but as a body they appear to prefer the position of outfielders in this arena. There are two notable characteristics of the active and skilled physician—a close observation of detail and a deft attention to the matter in hand—the duty of the hour, of the moment. These qualifications are admirably suited to the requirements of public life. No more favorable hope can be expressed for the future than that the members of this great profession will again resume an active interest and prominent position in the political affairs of the state and nation.

The physician of the future will have no easy berth, for, in his profession, as in all others, fitness, tact, erudition and industry must win the way. The sluggard, the ignoramus and the indifferent must fall by the wayside.

The number of people entering the medical profession is probably too great. In the United States of America, including the Philippines, Porto Rico and Hawaii, there were in 1901, 115,222 physicians in a population of 84,332,610. The last complete data we have concerning the number of attendants in medical schools are for 1899. In this year there were, excluding graduate schools, 156 medical schools in the United States with 24,119 students. The growth in the number of medical students in twenty-one years has been 142 per cent.

In addition to these undergradute schools there are eight graduate medical schools which had (in 1895) 624 instructors and 1,813 students, of whom 59 were women.

In Germany the conditions are quite unsatisfactory and the overcrowding of the medical profession in that country is a matter of grave concern. There are now in the empire 29,200 physicians, which doubles the number found in 1876. In other words there is one physician in Germany for every 1,700 inhabitants. In the city of Berlin 46 per cent. of all the physicians have an income of less than $700, and five per cent. of the whole number do not have a sufficient income to return it for taxation.

On the other hand, in the legal profession in Germany 80 per cent. of the lawyers have an income exceeding $2,000.

It is estimated that the preparation of a man for the duties of a physician in Germany costs about $6,000, and thus it is seen that the income is often less than 10 per cent. of the fixed charge on the capital invested. This leaves practically nothing for the reward of his own personal services, nor for wear and tear.

What are to be the remedies for this condition of affairs in the future? Shall the physicians organize a union and admit only a certain number of apprentices each year, or shall they have the requirements for admission, when properly applied, exclude all those who are not extremely well prepared? In the great school of the Beaux Arts in Paris the number of admissions is strictly limited and, perhaps, the great world school of medicine will have to come to this condition of affairs. In fact, an approach has been made already in at least one great medical school of this country, and candidates for the degree of doctor of medicine are not admitted until they hold a previous degree of an academic character or study equal thereto equivalent to the course of study required for the ordinary degree of bachelor of arts. The effect, however, which was anticipated in this particular instance was not realized. Indeed, there was at first a diminution in the number of students in attendance, but, attracted by the greater fame which a degree from such an institution would afford, this condition was gradually overcome and the actual

number of attendants became greater than when admission was easier.

This is indeed a serious question. I doubt if the charge for medical services in the country can be much larger than $1.00 per head, and it is thus seen that the 115,000 physicians of this country must be content to divide among them a paltry income of less than $90,000,000 at the present time.

Finally, the physician of the future will find his greatest service in prolonging human life. I am not here to claim that human life is so valuable that it needs always to be prolonged. This may not be so from the general economic condition of affairs, but, personally, I think we are all more or less interested in longevity. It can not be denied that there is a distinct economical gain in putting a man out of the world after he has passed his prime and before be becomes a burden upon his friends or the community. The asylum and the poorhouse are not to be regarded as shining lights of advanced political economy, but there is something in life besides mere political economy, and the prolongation of existence is regarded as one of the chief functions both of the medical profession and of public charities.

On the other hand, it must be considered that there is a distinct economical loss in cutting off from existence a man before he has run the full course of his career. To train a man for usefulness requires now fully a quarter of a century, and it seems only fair that he should have at least twice that time for the manifestation of his activities. If, therefore, he be cut off at thirty-five, forty or forty-five, the community is robbed of service to which it is entitled.

If old age could be secured without much of the burden now attending it, there would be the gradual ripening and mellowing of all the functions of the body and mind. If, in short, the human organism could be so constructed and cared for that it would continue its functional activity like the wonderful 'one hoss shay' until the time of its final dissolution, such a consummation is devoutly to be wished.

The medical profession of the future will find its best exponent in the service of senectitude. An old age without illness or dementation, a ripening without decay, a completion of the functional activity without the breaking down of any organ are steps toward which the medical profession of the future may well direct its energies.

Death should not be regarded as a misfortune, but as an end, as a termination of a journey which has been filled with delight, as a rest for weariness which comes with the natural order of labor, as an euthanasia and not a dreadful disaster.

H. W. WILEY.
U. S. DEPARTMENT OF AGRICULTURE.

PROCEEDINGS OF THE CENTRAL BRANCH OF THE AMERICAN SOCIETY OF ZOOLOGISTS.

THE third annual meeting of the Central Branch of the American Society of Zoologists, and the sixth annual meeting of the society since its original establishment was held at the University of Chicago, March 31 and April 1, 1905.

The following having received the votes of the executive committees of both branches were elected to membership in the central branch: James Francis Abbott, Bennet M. Allen, Lawrence Edmunds Griffin, Lynds Jones, C. E. McClung, George Wagner, L. M. Walton, Samuel L. Williston, Charles Zeleny.

The bill on vivisection before the Illinois State Legislature was discussed and it was

VOTED, That this society concur in the following resolution and instruct the secre-

tary to communicate this action to the Central Branch of the American Society of Naturalists:

Resolution: "It having come to the attention of the Central Branch of the American Society of Naturalists that a bill has been introduced into the Illinois State Legislature which would restrict the freedom of scientific investigation in Illinois,

"*Be it Resolved:* That the members of this society protest against such legislation as is contemplated in Senate Bill No. 271, because it is inimical to the interests of science and would seriously obstruct the advance of knowledge concerning the nature and cure of disease in man."

The officers elected for the ensuing year and those holding over are as follows:

President—Frank R. Lillie.
Vice-President—William A. Locy.
Secretary-Treasurer—C. E. McClung.
Additional Members of the Executive Committee—C. H. Eigenmann, for three years; Herbert Osborn, for two years; Thomas G. Lee, for one year.

The following are titles and abstracts of papers presented at the meeting:

The Origin of the Sex-Cords and Rete-Cords of Chrysemys: Bennet M. Allen, University of Wisconsin.

In an early stage of development (embryo of 7 mm. total length), each of the more ventral Malpighian corpuscles of the mesonephros is still attached to the peritoneum by a neck of cells which sometimes possesses a lumen and constitutes a peritoneal funnel. There are usually four, sometimes three, such Malpighian corpuscles in each somite. A peritoneal ingrowth arises either directly from the base of each peritoneal funnel or just mediad of it. These ingrowths are termed funnel sex-cords. Other sex-cords arise from the peritoneum between the funnel sex-cords and the mesentery. These anastomose with the funnel sex-cords which in turn unite with evaginations from their corresponding Malpighian corpuscles after the latter have broken away from the peritoneum. The bridges thus formed between the funnel sex-cords and Malpighian corpuscles constitute the rete-cords which are thus formed from the distal portions of the funnel sex-cords plus evaginations from the Malpighian corpuscles. The foregoing applies to the sex-gland along its entire length.

The distal ends of all the funnel sex-cords and of many of the other sex-cords contribute to the formation of the adrenal bodies.

The anterior portion of the sex-gland of the turtle is homodynamous with the rete region of the genital ridge of the mammals (pig and rabbit).

Further Notes on the Chromosome Complex of Orthopteran Spermatocytes: C. E. McClung, University of Kansas.

A careful study of a large number of species indicates that the members of a family possess a common number of chromosomes. In each species there is found a characteristic series of chromosome forms, and these are in many cases peculiarly associated. In some cases the grouping is characteristic of the genus, and within the genus the species are marked by variations in size of chromosomes and other parts of the cell. Heterotypical mitoses occur in spermatogonia, first spermatocytes, and second spermatocytes, and in each case witness a longitudinal division of the chromatin thread. In the spermatocytes all the chromosomes do not divide in the same manner. These irregularities of association and division are largely due to the action of the accessory chromosome, which in some cases unite with the one tetrad, forming a trivalent element, and in others with two tetrads, producing a pentivalent mutiple chromosome. From these observa-

tions it is concluded that generic and specific characters are the result of differences in size and associations of chromosomes, and not to variations in numbers. It is also thought that continuous variation may be due to slight differences in size of the chromosomes of the germ cells, while discontinuous variation would be due to alterations in the relations of chromosomes to each other.

Regeneration in Nudibranchs: C. M. CHILD, University of Chicago.

Several species of æolids abundant in the Pacific Grove region were used for experiment.

It was found that removal of a portion of the body posterior to the middle was followed by rapid regeneration. The larger the portion removed the more rapid the regeneration.

The ganglionic mass is situated posterior to the second pair of tentacles; removal of the whole head anterior to the ganglia was followed by rapid and complete regeneration. When the ganglia were removed no regeneration beyond healing of the wound occurred, though the animals often lived for two weeks.

Regeneration of posterior portions of the body was less rapid in specimens from which the head anterior to the ganglia had been removed than in specimens with uninjured head. The specimens from which the head region had been removed had lost their principal sense organs, but still retained the central nervous system intact. They were much less active than specimens with normal heads and the posterior parts were consequently subjected in much less degree to the conditions accompanying functional activity of this region; hence in all probability the less rapid regeneration. After the new head regenerated, posterior regeneration in these pieces was fully as rapid as in those with uninjured heads. Removal of other portions of the body such as the lateral regions of the foot, etc., had no effect upon the rapidity of posterior regeneration.

If the animals are not fed a marked reduction in size, often 50 per cent., occurs in the course of two or three weeks.

The Relation of the Degree of Injury to the Rate of Regeneration: CHARLES ZELENY, Indiana University.

Two series of the crayfish, *Cambarus propinquus,* differing only in the degree of injury which they had sustained, were compared with regard to the rate of regeneration of the right chela and the rate of moulting. In one series, AA_2, the right chela was removed at its breaking joint. In the other series, BB_2, both chelae were removed at their breaking joints and the last two pairs of walking legs were likewise removed. Series AA_2 comprised 36 individuals and series BB_2 41 individuals.

A comparison of the two series was made 95 days, 130 days and 153 days after the operation. In each case the data show very definitely that the series with the *greater* injury molts *sooner* than the one with the *lesser* injury and also regenerates *each* of its two chelæ more rapidly than the latter regenerates its *one* removed chela.

Experimental Evidence Concerning the Production and the Preservation of Acquired Characters: W. L. TOWER, University of Chicago.

Dominance; a Potent Factor in the Extinction of Species: W. L. TOWER, University of Chicago. Read by title only.

The Origin and Distribution of Tropical American Fresh-water Fish: C. H. EIGENMANN, Indiana University.

The Sequence of Organisms in a Protozoan Culture and its Irreversibility: AMOS W. PETERS, Zoological Laboratory, University of Illinois.

A definite procedure is followed in the setting and care of protozoan cultures with a medium of hay infusion. The seed here used came from previous laboratory cultures or from field collections. The physiological conditions are determined at almost daily intervals by physical and chemical methods. Evidence so obtained points to fermentative action as the beginning of metabolism in the culture. The curve for acidity is of much physiological significance. An approximate method of estimation is used to compare the relative abundance of the different organisms and the results are represented by curves. Relative curves have been approximately determined for bacteria, *Colpidium*, *Paramœcium*, *Amœba*, some *Hypotricha*, *Arcella*, some Rotifera and *Stentor*. All efforts to change well-defined curves to decidedly different relative positions in the history of the culture have failed. The maxima of the curves can not be interchanged by reseeding. Since reseeding was not practised (except for experiment) the cysts or spores of all the organisms found must have been continually present. Mutual antagonism of the different forms is not a probable explanation. The serial succession of the organisms and the parallel physicochemical changes in the environment point to *specific adjustment* as a probable hypothesis. The determination of some of the specific adjustments of *Paramœcium* and *Stentor* supports this hypothesis.

An Analysis of Physiological Conditions in a Protozoan Culture: Amos W. Peters, Zoological Laboratory, University of Illinois.

The influence of the physiological states of protozoa in producing variations from a supposed standard is seen in the results of experiments upon both the directional and the metabolic reactions of this group. To obviate this important difficulty the writer proposes to standardize the given conditions of any culture. Standardization of the conditions, if successful, uses the peculiarities of the physiological states for a more accurate interpretation of the results of experiment, instead of leaving these states as objectionable factors in an experimental procedure.

The methods to be used must conform to at least two conditions. First, they must not require more than a small amount of culture liquid (5 to 10 c.c.) for a test, in order that serial observations can be made upon the same culture. Second, they must be sufficiently accurate and sensitive to yield results that show the successive small differences which occur in the history of a single culture. The special methods here applied are mostly volumetric and comprise the determination of: (1) Qualitative chemical content, (2) free acidity or alkalinity, (3) dissolved oxygen, (4) bicarbonates, (5) alkali earths, (6) electrical conductivity, (7) oxygen consumed, (8) sulphated nitrogen, (9) ammoniacal nitrogen, (10) individual salts—nitrites, nitrates, chlorides, potassium, calcium, etc. For both convenience and accuracy, a system of standardizing all the necessary volumetric solutions in terms of one original standard acid has been devised. By these methods one series of data has been taken from various media promiscuously selected for comparison, and another series comes from the history of single cultures. In both series the biological aspect of the media was known. Comparison of the physicochemical and the biological data indicates that variations in the former are an approximate expression for corresponding changes in the physiological states of the organisms. The methods here selected are therefore serviceable for the physiological estimation of the protozoan environment.

The Evolution of Color Characters: R. M. STRONG, University of Chicago.

Color characters are purely relative means of distinguishing various individuals or groups of animals, and their significance varies according to the experience and knowledge of the observer. In birds, color characters are all connected by series of transitional stages which appear perfectly continuous even after careful analysis, and the most highly developed characters may be found in incipient stages not ordinarily observable. A study of the colors of birds has led the writer to believe strongly in an orthogenetic theory of evolution of color characters by continuous variation in birds.

Some Observations on the Litoral Fauna of Pacific Grove, Cal.: C. M. CHILD, University of Chicago.

The Entomological Ecology of the Indian-corn Plant: S. A. FORBES, University of Illinois.

This paper consists of material in pure ecology selected from the mass of matter accumulated in the course of several years' study of the corn insects from the economic point of view. It deals with adaptive relations of the corn insects to their food plant and to one another; classifies adaptations of insects to their food as structural, physiological, psychological, local, biographical and numerical, giving illustrations of each class; discusses the adjustment by natural selection of the life histories of insects dependent upon the same plant; analyzes examples of competition among such insects; refers to the agency of natural selection in transforming competitions from the simultaneous to the serial order; and theorizes the whole subject by reference to the general principle of a community of interest between a phytophagous insect and its food plants.

The Fauna of Mayfield's Cave: ARTHUR M. BANTA, Indiana University.

Mayfield's Cave is a small cave near Bloomington, Ind., which presents typical cave conditions having a nearly constant temperature and conditions of light shading from twilight to absolute darkness. Eighty-seven species of animals were taken in this cave as against 68 heretofore known from all of the Indiana caves. Of the 87 species but 21 are permanent residents and only 8 are found in caves exclusively. Species including diptera, lepidoptera (2 species), arachnida and the bats hibernate in the cave in considerable numbers. Each cave inhabitant sustains a certain definite relation to the light, some living only in absolute darkness, others in dim twilight, etc. Aside from conditions of light and temperature, the distribution of cave animals is influenced by moisture, the presence of organic matter which serves as food and the presence of means of concealment. Some of the highly modified and truly cavernicolous forms are occasionally found outside of caves in springs, about wells, in drains and in similar situations. Change of seasons has little influence upon cave life. Species which are only temporary residents and some of the less highly specialized of the permanent residents are young and local cave forms, while the highly specialized cave inhabitants such as the blind fish, blind cray-fish and the blind carabids are old and widely distributed cave forms. The nearest relatives of cave forms are nocturnal or are dark or shade-loving species, while the food and habits of cave species are exactly similar to the food and habits of their near relatives living in other situations. The habit of hiding under loose stones and other debris persists in many cave forms where the habit is apparently altogether useless. *Cambarus bartoni* living in the cave possesses less

pigment, and their antennæ are eleven per cent. longer compared with individuals of the same species living outside.

Guinea-chicken Hybrids: Michael F. Guyer, University of Cincinnati.

These hybrids, five in number, were produced by crossing a black Langshang cock with a common guinea hen. When young the hybrids resembled more young guineas, although the shanks were feathered, as were those of the father. Traces of these feathers still (nearly three years later) persist. The hybrids are much larger than guineas and have louder and even more discordant voices. They are extremely wild. The head shows no trace of either the comb of the chicken or the helmet of the guinea, but is covered with feathers clear to the beak. Neither are wattles nor earlobes present. The beak, in color and shape, resembles more that of the guinea. A trace of the guinea's white face is discernible in the hybrid in the immediate region of the eyes. The neck is very long and snake-like. The feathers are more or less intermediate in structure between those of the parent forms. The tail is erect and never droops like that of the guinea. The large quill feathers of tail and wing not infrequently possess vanes which are black on one side of the rachis and more like the hybrid general plumage on the other. The first one to three primaries are white in all of the hybrids. Guineas frequently show similar white primaries. The color of the head and neck is mainly black, although in two of the forms, there is a decided sprinkling of white feathers in this region. The general ground color of body, wing and tail plumage is dark gray in three of the hybrids, but in the remaining two it verges more toward a chestnut color. In all, the feathers are crossed by narrow lighter colored V-shaped bars which gives the plumage, on the whole, a decidedly barred appearance. The conspicuous white dot of the guinea's plumage seems to be entirely lost. There is, however, a secondary inconspicuous barring in many of the features of the guinea which possibly may be the source of the bars of the hybrid. The forms have not proved fertile and the chief interest in them will center in the chromosomal structures of the germ cells. At present there is no means of telling their sex.

Notes on Cross-bred Chickens: Michael F. Guyer, University of Cincinnati.

Barred or white Plymouth Rocks and brown Leghorns were used in crossing. There is much question regarding the exact ancestry of Plymouth Rocks, but undoubtedly the American Dominique and the black Java are the main sources, with probably also a considerable admixture of Brahma blood. The brown Leghorn of today appears to be the descendant of an old breed of fowls introduced from Italy in 1834.

The offspring, 400 in number, of brown Leghorn ♂ × Plymouth Rock ♀ were every one black, except for an occasional feather of reddish hue in some of the cocks. While in plumage they thus seem to revert to the ancestral black Java, this is not so true of shape and weight, which varies in all degrees between that of the two parent types. The white ear lobes of the Leghorn always persist. Some of the progeny, indeed, resemble black Minorcas very closely. Most of them have the dark slate-colored shanks that commonly accompany black fowls, although about 30 per cent. are yellow shanked. The comb is the most variable structure, exhibiting 3 or 4 to 7 serrations. Not infrequently double combs (two single ones side by side) appear in the cocks. Various crosses among the members of this generation and between them and the parent stocks were made, but

the limits of an abstract will not permit record of these results. On the whole, no characters observed, appeared to follow the laws of Mendel with any accuracy. For example, black × black have invariably produced black offspring, so far with the white ear lobes persisting. A black ♂ × barred plymouth ♀, among others, produced one male offspring which rather closely resembles a dark Brahma cock.

Pure white Plymouth Rocks which always produced white offspring when bred together, never produced white offspring when crossed either way with brown Leghorns, nor did any of the mongrel offspring, when interbred. The majority of the offspring were barred, the remainder being nondescripts or occasionally black. Interbreeding this generation resulted in the production of several fowls which were of a pure barred Plymouth Rock type except for the persistent white ear lobes of Leghorn origin.

Observations on some Peculiar Habits of the Mole-crickets: W. J. BAUMGARTNER, Kansas University.

The *female* of our northern mole-cricket, *Gryllotalpa borealis*, has quite a loud and distinct chirp. This seems to be used as a means of recognition in their dark burrows. This observation is contradictory to the conclusion of all writers who say only male orthoptera chirp, or stridulate. The female of the Porto Rican species *Scopteriscus didactylus* has the same kind of a stridulating organ (much smaller and weaker than that of the male) on its elytra, and so I conclude it also chirps.

Du Four's gland of 'excretory secretion,' which later investigators have connected with the copulatory organs, is by my observations and experiments shown to be an effective protective device. A strongly *fœtid* and very *sticky* secretion is ejected with considerable force from the siphon-like genito-anal opening. This must repel or retard the most ardent pursuer and so protect the soft abdomen from the rear.

In the act of copulation these insects assume the relative positions suited to their tunnel-like homes. They turn posterior end to posterior end and ventral side to ventral side, the male lying on his back. The sperm is transferred in a *spermatophore*. *Scopteriscus* has a similar protective gland, but its copulation was not observed.

The chirping of the female, the protective anal secretion and the unusual position of male and female in copulation which distinguish the mole-crickets from the rest of the orthoptera are very evidently adaptations to life in underground tunnels. The presence of the spermatophore accounts for the annexed glands in the male *Gryllotalpa*.

The Reflex Theory of Orientation as Applied to the Phototaxis of Ranalia: S. J. HOLMES, University of Michigan.

A Note on the Position of the Temporary Pharynx in the Planarian Embryo: W. C. CURTIS, University of Missouri.

Mattiesen in his extensive account of the embryology of the European *Planaria torva*, which has been recently published in the *Zeitschrift für Wissenschaftliche Zoologie* ('04), suggests that my description of the orientation of the adult and embryonic pharyngeal structures in *P. maculata* must have been due to the examination of a single abnormal specimen or to distortion caused by poor fixation. My observation has been confirmed by Bardeen ('02); and in another American form, *P. simplicissima*, Stevens ('04) believes the same orientation to exist, although in this case the early disappearance of the primitive or embryonic pharynx makes the matter difficult to establish. Mattiesen finds that in *P. torva* the adult pharynx appears

just behind the degenerating embryonic pharynx, which is, therefore, located on the future ventral part of the body as the spherical embryo becomes flattened. This confirms Ijima's ('84) description of the orientation in *Dendrocœlum lacteum*. In *B. maculata* the point at which the degenerating embryonic pharynx is last seen is on the dorso-posterior surface.

The Arrangement of the Mesenteries in the Cerianthidæ. J. Playfair McMurrich, University of Michigan.

In 1892 Faurot observed that the mesenteries of *Cerianthus membranaceus* were arranged in groups of four, each quartet consisting of a longer and a shorter fertile mesentery alternating with a longer and a shorter sterile one, and his observation was subsequently confirmed by van Beneden for *C. Lloydii*. Both authors regarded the quartets as beginning with the fourth mesentery on each side of the mid-siphonoglyphic line. The study of the development of the cerianthid mesenteries has shown, however, that the first four mesenteries on either side of the mid-siphonoglyphic line constitute a group distinct from the others and are comparable to the eight protocnemes of the other groups of Anthozoa.

Among the 'Siboga' actinians is a species from Amboina, probably *C. elongatus* Kwietn. In this form there is on either side of the mid-siphonoglyphic line the usual short sterile directive mesentery, then follow two additional sterile mesenteries, and then a long fertile mesentery which extends almost to the aboral pole of the body. This last is apparently the so-called *continuous mesentery*, and the interest of it lies in the fact that it is the fourth mesentery and not the second, as in all other species that have been examined. This departure, which occurs in all the individuals of the species examined, corroborates the view based on the developmental history that the four mesenteries on either side of the mid-siphonoglyphic line constitute a group apart from the rest, and that the quartets should be regarded as beginning with the fifth mesenteries.

An Improved Form of Reconstruction Apparatus: Thomas G. Lee, Laboratory of Histology and Embryology, University of Minnesota.

Doctor Lee presented a very satisfactory form of reconstruction apparatus, which he had designed and which is an improvement over the models now in use. It consists of a cast-iron bed plate 8½ cm. (3¼ inches) thick at sides, and 4½ cm. (2 inches) thick in the middle. The top measures 23 x 30 cm. (9 x 12 inches), and has been accurately planed and polished, giving an area of 690 sq. cm. (108 sq. in.). The side pieces, by which the thickness of the wax plate is determined, are moved up an inclined plane which is rigidly fastened to the bed plate in a manner similar to the movement of the object holder in a Thoma microtome. All parts of the top of each side piece are thus always in the same plane. The side piece is moved up and down by a large and accurately made screw at the rear of the apparatus. After adjustment the side pieces can be firmly fixed in place by two set screws by means of a small wrench. A metal scale is placed on each side piece, so that any thickness of wax plate can be made from ½ mm. up to 1 cm. at ½ mm. intervals. Thus plates of ½, 1, 1½, 2, 2½ mm., etc., can be made. Projecting from the bed block are two metal strips with a depression to hold the roller when not in use. This whole apparatus weighs about 67 pounds, and is quite rigid.

The roller is of polished steel 30 cm. (12 inches) long by 6 cm. (2½ inches) diameter, with a steel rod projecting at each end and covered by a movable wooden handle. This

roller weighs 17 pounds, but works very easily, indeed.

The heating apparatus consists of a metal frame supporting a copper jacket which has a concavity on its upper surface just a little larger in diameter than that of the roller. This protects the surface of the roller from contact with either the metal or flame. This concavity could easily be changed into a hot water bath for the roller, if so desired. The lamp is a horizontal Bunsen burner tube with numerous small openings. The roller does not require to be heated between each pair of plates, and thus when not in use it is readily rolled up into the support in front of the bed plate.

This whole apparatus is very solid, compact, accurate and easy to adjust.

Some Abnormalities of Growth Produced by Parasites on Alcyonaria: C. C. NUTTING, State University of Iowa.

In their 'Report on the Alcyonaria of the *Challenger* Expedition,' Wright and Studer described a new genus, *Calypterinus*, giving as a generic character a certain tunnel-like structure formed by excessively enlarged spicules, the tunnel being along one side of the stem or branch. Later Studer, in reporting on the Alcyonaria secured by the Prince of Monaco's yacht, declares that this peculiar structure is due to the presence of an annelid, and is pathological in fact. A similar structure was found by the writer in a species of *Tenella* secured by the *Albatross* from Hawaiian waters. The tunnel-like structures, with the annelids inside, were shown by means of lantern slides.

In a new species of *Dasygorgia* from the same collection the writer found certain very greatly enlarged polyps which at first looked like a form of dimorphism hitherto unknown. Upon dissection, however, these monstrous polyps were found to contain, without exception, minute crustaceans, either embryos or some form of degraded parasite. These were also shown by means of lantern slides from photographs made by the author. It appears that we have here a condition of affairs in an animal organism which bears a close analogy to the production of 'galls' in vegetable tissues.

The Origin of the Subclavian Artery in the Chick: WM. A. LOCY, Northwestern University. (Based on the work of Mr. Sabin.)

The subclavian artery in birds lies ventral to the vagus nerve and vena cava; in mammals it occupies a dorsal position with reference to those structures. On this account the subclavian arteries do not appear to be homologous as to origin in these two classes of vertebrates. Hochstetter was the first in 1890 to clear the question by showing that the definitive subclavian in birds is of secondary origin. Prior to its appearance there is a vessel arising from the dorsal aorta, opposite the 15th mesodermic somite, which supplies blood to the wing-bud from the third to the sixth day of development. On the sixth day the secondary subclavian arises from the ventral end of the third aortic arch. This new vessel passes backward and joins with the primary subclavian artery, coming from the dorsal aorta, and, from the sixth to the close of the seventh day of development, the wing bud receives blood from the two sources. The primary subclavian then disappears and the secondary subclavian remains as the permanent one.

Mr. C. G. Sabin, a graduate student in Northwestern University, has traced with great care the embryonic history of the subclavians in the bird and has illustrated the same. His results agree closely with those of Hochstetter, except that he finds the primary subclavian in earlier stages than Hochstetter, and observes that in the early condition the subclavian arises inde-

pendently of the segmental arteries, with which, however, they join later. The illustrations which Mr. Sabin gives of the actual condition of the developing subclavian arteries were very much to be desired, since Hochstetter's paper was illustrated only by a few simple diagrams. The results are now published in the *Anatomischer Anzeiger*, Vol. 26, Nos. 11 and 12, with 29 illustrations.

The following demonstrations were made before the society:

1. William A. Locy, Northwestern University, 'Dissections Showing the Nervus Terminalis in *Scyllium*, *Trygon* and other Selachians.'

2. William S. Miller, University of Wisconsin, 'Demonstration of the Lymphatics of the Lung and Stomach in *Necturus*.'

3. Bennet M. Allen, University of Wisconsin, 'Models showing the Origin of the Sex-cords and Rete-cords in *Chrysemys*.'

Frank R. Lillie,
Secretary.

SCIENTIFIC JOURNALS AND ARTICLES.

The April-May number of *The Journal of Geology* contains an article on 'The Zuni Salt Lake' of western New Mexico, by Mr. N. H. Darton. It is illustrated by two maps and three half-tones. Mr. Douglass W. Johnson reviews 'The Tertiary History of the Tennessee River' and concludes that it has followed its present course through Walden Ridge for a long time, 'probably since the close of the Cretaceous period at least.' This article is illustrated by nine figures. Professor B. Shimek contributes an 'Additional Note on *Helicina occulata*,' a recent species, which also occurs as a fossil in the loess, and concludes that it supports the view that 'during the deposition of the fossiliferous loess the climate was not glacial.' Mr. Rollin T. Chamberlin describes 'The Glacial Features of the St. Croix Dalles Region,' which is illustrated by three sketch maps. Professor Stuart Weller describes 'A Fossil Starfish from the Cretaceous of Wyoming,' which he names *Pentagonaster browni*. Mr. O. W. Willcox contributes an article on 'The So-called Alkali Spots of the Younger Drift-sheets,' which are patches of white efflorescence which 'consist of small amounts of sodium chloride and much larger amounts of the carbonates and sulphates of magnesium and calcium.' Mr. George C. Matson has a paper on the 'Peridotite Dikes near Ithaca, N. Y.,' in which he describes several new dikes in addition to those noted over sixty years ago by Vanuxem and much more recently by Professor Kemp, and Mr. Wallace W. Atwood describes the 'Glaciation of San Francisco Mountain, Arizona.' This article is illustrated by a sketch map of the top of the mountain and it is stated that these records 'may possibly be those of the southernmost ice which existed in this country during the Pleistocene period.'

To the *American Geologist* for April Professor Eugene A. Smith contributes a 'Biographical Sketch of Henry McCalley' with portrait. Professor Warren Upham has an article on 'The Nebular and Planetesimal Theories of the Earth's Origin,' in which he quotes at length from Dr. T. C. Chamberlin's recent paper on the planetesimal hypothesis. Professor Upham also quotes from Dr. G. K. Gilbert's paper on 'The Moon's Face' and concludes that his explanation of the origin of the very abundant small and large crateriform features of the moon seems largely identical with Chamberlin's hypothesis 'so far as that hypothesis deals with the segregation of the originally nebulous matter to form planets and satellites.' Professor J. W. Spencer reviews 'Dr. Nansen's Bathymetrical Features of the North Polar Sea, with a Discussion of the Continental Shelves and the Previous Oscillations of the Shore Line.' Mr. Spencer says that while this memoir 'treats of the physiographic features of the Polar basin, yet the greater part is devoted to the investigation of continental shelves, not merely of the Arctic basin, but also those of the Atlantic, in which respect it is the most important work that has appeared anywhere. 'Professor

Shimek's criticism of the aqueous origin of Loess' is answered by Professor G. Frederick Wright. Mr. Paul W. Prutzman discusses the 'Chemistry of California Petroleum,' and the number concludes with an article by Professor Lawrence M. Lambe, 'On the Tooth-Structure of *Mesohippus westoni* (Cope),' which is illustrated by one plate giving four views of an upper molar of this primitive species.

The American Naturalist for March contains the following articles: 'The Anatomical Changes in the Structure of the Vascular Cylinder, Incident to the Hybridization of the Catalpa,' by D. P. Penhallow; 'The Occurrence and Origin of Amber in the Eastern United States,' Arthur Hollick; 'Fresh-water Rhizopods from the White Mountain Region of New Hampshire,' J. A. Cushman and W. P. Henderson; and 'The Reactions of the Pomace Fly (*Drosophila ampelophila* Loew) to Light, Gravity and Mechanical Stimulation,' by F. W. Carpenter. There are, besides, reviews of scientific literature.

ARTERIOSCLEROSIS in its relation to diseases of the nervous system is the subject of the opening paper in the May issue of the *Journal of Nervous and Mental Disease*. Dr. E. D. Fisher discusses the clinical aspect, and Dr. Harlow Brooks summarizes the pathology, with reports of three illustrative cases, one of syphilis of the cerebro-spinal axis, one of arteriosclerosis of the brain and spinal cord occurring in alcoholism, and one of acute arteritis occurring in vessels of the central nervous system in rabies. Drs. W. G. Spiller and C. H. Frazier follow with the presentation of some original views on the subject of nerve anastomoses. They have experimented in this line in the treatment of cerebral palsies, and their suggestions open up a field in neurological surgery that seems to be full of promise. Dr. Spiller also contributes a short illustrated paper, being mainly the report of a case which came under his observation and seemed to offer valid evidence for the location of the fibers of temperature and pain within the tracts of Gower. Dr. Jas. W. Wherry writes on the curability of epilepsy, and takes an optimistic view of the question, conditioned on beginning treatment promptly upon the appearance of the disease. His idea of the requirements in such treatment consists of 'A study of each case individually; special adaptation of drugs to individual conditions; personal supervision and individualization of diet, absolute change of environment.' The proceedings of the New York Neurological Society for December 6, 1904, and of the Philadelphia Society for December 27, 1904, are reported.

SOCIETIES AND ACADEMIES.

THE IOWA ACADEMY OF SCIENCES.

THE nineteenth annual meeting of the Iowa Academy of Sciences was held in the chemical lecure room of Iowa College at Grinnell, Ia., April 20 and 21. The following papers were presented:

B. SHIMEK: President's address, 'Botany and Intelligent Citizenship.'

C. C. NUTTING: 'The U. S. S. *Albatross* and its Work' (illustrated with lantern slides taken by the author).

L. S. ROSS: 'Apparatus for Plating Out Petri Dishes in the Field.'

BRUCE FINK: 'Some Studies in American Cladonias.'

L. H. PAMMEL: 'Some Notes on the Flora of the Bitter Root Mountains of Montana.'

JAMES E. GOW: 'An Ecological Study of the Sabine and Neches Valleys, Texas.'

W. S. HENDRIXSON: (*a*) 'Action of Bromic Acid on Metal,' (*b*) 'Determination of Bromic and Iodic Acids.'

R. E. BUCHANAN: 'A Study of a Thermophilic Bacterium.'

L. BEGEMAN: 'J. J. Thomson's Theory of Matter.'

H. S. FAWCETT: 'Variation in the Ray Flowers of *Anthemis Cotula* and Other Composites.'

T. H. MACBRIDE: 'Some Slime Moulds of New Mexico.'

B. H. BAILEY: 'Report on Some Iowa Birds.'

NICHOLAS KNIGHT: 'Different Methods of Determining Carbon Dioxide in Minerals and Rocks.'

MORTON E. PECK: 'Flora of Hardin County.'

C. F. LORENZ: 'Three-Color Projection.'

BRUCE FINK: 'Notes on Some Iowa Algæ.'

GRACE ROOD RUEDA: 'The Biology of *Bacillus Violaceus Laurentius*.'

J. P. Anderson: 'Plants New to the Flora of Decatur County, with Summary.'

R. B. Wylie: 'The Morphology of Vallisneria Spiralis' (illustrated).

J. L. Tilton: 'A Problem in Municipal Water-Works for a Small Town.'

T. J. Fitzpatrick: 'The Liliaceæ of Iowa.'

J. M. Lindly: 'The Flowering Plants of Henry County.'

J. L. Tilton: 'The Storage Battery and Switchboard at Simpson College.'

Fred J. Seaver: 'An Annotated List of Iowa Discomycetes.'

Charles R. Keyes: 'Northward Extension of the Lake Valley Limestone.'

Charles R. Keyes: 'Geological Structure of the Jornada Del Muerto and Adjoining Bolson Plains.'

Charles R. Keyes: 'Bisection of Mountain Blocks in the Great Basin Region.'

A. C. Page: 'A Laboratory Barometer.'

Edwin Morrison: 'Cohesion of Liquids and Molecular Weights.'

C. O. Bates: 'Municipal Hygiene.'

L. H. Pammel and Estelle D. Fogel: 'Some Bacteriological Analyses of Railroad Water Supplies.'

The following officers were elected for the ensuing year:

President—M. F. Arey, Cedar Falls.

First Vice President—J. L. Tilton, Indianola.

Second Vice President—C. O. Bates, Cedar Rapids.

Secretary—T. E. Savage, Des Moines.

Treasurer—H. E. Summers, Ames.

T. E. Savage,
Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

The regular meeting of the academy was held in Syracuse, on the evening of April 15. Professor W. M. Davis, of Harvard University, gave an illustrated lecture on the Colorado Canyon, based upon four visits to the Arizona plateaus. He emphasized the origin of the canyon as a valley of normal erosion exceptional only in depth, as shown fifty years ago by Newberry; its independence of the great fractures of the region whose course is usually north and south, as shown thirty years ago by Powell and Dutton, while the canyon is cut from east to west; and the record of a long geological history magnificently displayed in the canyon walls. This history of the region was traced backwards, first stripping off the horizontal layers of the plateau series, next reconstructing, untilting and stripping off the now inclined layers of the so-called Algonkian 'wedge' and then roughly building the lost mountains of the crystalline foundation rocks, commonly regarded as Archean but not yet demonstrated to be of so great antiquity. Having thus traveled backwards through the 'corridors of time' to the earliest stage of geological history there recorded, the return journey was made along the normal succession of events. Six long ages of time, occupied alternately by deposition and by erosion, were thus reviewed: Three ages of enormous deposition, requiring a correspondingly enormous erosion elsewhere, and three alternate ages of enormous erosion, suggesting an equally enormous deposition elsewhere. The short chapter of canyon erosion was entered upon only after the long earlier ages were closed: thus a correction was suggested for the erroneous view that the erosion of a great canyon requires a long part of geological time. The apex of the Algonkian wedge and the associated ancient plains or peneplains of erosion, best seen from Grand View, sixteen miles east of the railroad terminus, were indicated as the points on which the attention of the inquiring visitor should be focussed. The volcanic history of the district, as associated with the erosion of the canyon, was briefly touched upon.

J. E. Kirkwood,
Corresponding Secretary.

THE NEW YORK ACADEMY OF SCIENCES. SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

A meeting was held on February 27, in conjunction with the Ethnological Society. General Wilson occupied the chair. The following papers were presented: 'Anthropometry of the Jews of New York,' Maurice Fishberg. Whether the Jews have maintained their racial purity to the present day is a question that can be examined by comparing the physical type of Jew from different countries. Extensive measurements of Jewish

immigrants in New York from various countries of eastern Europe show that the Jewish type in those countries is not Semitic, but varies in the different countries, always approximating, in stature and cephalic index, to the native or Christian population of the respective countries.

'Anthropometric Work at the St. Louis Exposition,' R. S. Woodworth and F. G. Bruner. As many as possible of the racial groups represented at the exposition were measured. The best material was found among the Philippine Islanders, of whom about 700 were measured. The Christianized tribes, such as the Tagalog, Pampango, Ilocano, Bicol, Visaya, were found very uniform in physical type. Measurements showed no clear evidence of differentiation among them. The average height of the several tribes differed but little from 161 cm., the cephalic index differs little from 83, etc. The Moros of Mindanao also are practically identical in physical type with the Christian tribes. The pagan Igorots and Bagobos seem to differ considerably from this type, especially in height, which is about 155 cm.; while the Negritos were clearly marked off from all the rest by their kinky hair, small stature (144 cm.), broad nose, and small head in proportion to stature.

R. S. WOODWORTH,
Secretary.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 600th regular meeting, held April 15, 1905, was celebrated by historical addresses in University Hall of the George Washington University, followed by a social hour with refreshments.

After a brief address by President Littlehales, half a dozen papers were read giving a review of the activities of the society since its foundation in 1871, under the presidency of Joseph Henry, in the lines of most interest to its present membership. Mr. Gore grouped and characterized succinctly the papers presented in mathematics. Mr. Wead reviewed the papers on physics, beginning with Henry's 'Aberrations of Fog Signals' and including recent notable work on aerodynamics. Mr. Clarke told of the great local development of activity in chemistry since 1871. Mr. Gilbert spoke of the opportunities the society had furnished to discuss questions in geology, instancing cases where the discussions had led to important researches. Mr. Hayford recalled some of the notable advances in geodesy that had been presented to the society, Mr. Eichelberger reported on the papers in astronomy and Mr. Bauer spoke of the activity in electricity and magnetism. A brief letter from Dr. Gill was read regarding the interest in biology before the formation of the other scientific societies.

THE 601st meeting was held April 29, 1905.

Professor W. S. Eichelberger exhibited one of the Riefler self-winding astronomical clocks belonging to the Naval Observatory and described its construction. It is in a case from which about one eighth of the air is exhausted; the pendulum is of nickel-steel alloy compensated; the power comes from two small cells of battery and is applied about twice a minute. The rate is very small and very constant.

Professor F. H. Bigelow then spoke on 'Ionization and Temperature-Effects in the Atmosphere.' The great problems in meteorology relate to the vertical distribution and semidiurnal curve of temperatures; and to the variations in vapor tension, atmospheric electricity and magnetic field. A great number of curves representing the results of observations on the quantities involved in these problems were exhibited, and the attempt was made to explain the facts according to the modern theory of ionization. The paper will appear in the *Monthly Weather Review*.

CHARLES K. WEAD,
Secretary.

THE SCIENCE CLUB OF NORTHWESTERN UNIVERSITY.

THE Science Club held its regular monthly meeting on Friday, April 7, 1905, at 7:30 P.M.

The following papers were presented:

MR. G. G. BECKNELL: 'An Investigation of the Residual Current of the Electric Arc.'

MR. GORDON FULCHER: 'The Duddell Oscillograph.'

Professor O. H. Basquin: 'The Bending Moment of a Uniformly Loaded Beam; a New Experimental Demonstration.'

Floyd Field,
Secretary.

DISCUSSION AND CORRESPONDENCE.

CONNECTION BY PRECISE LEVELING BETWEEN THE ATLANTIC AND PACIFIC OCEANS.

To the Editor of Science: In your issue of April 28, 1905, page 673, is an article by Mr. Hayford on 'Connection by Precise Leveling between the Atlantic and Pacific Oceans.' About twenty years ago I wrote to Science in connection with precise leveling over the Alleghanies and the Rocky Mountains, and stated that it might be well to have a systematic determination of bench marks at stated intervals owing to the unrest in the earth's crust. At that time I stated that my work on the corps of the Pennsylvania Railroad had shown me that, however carefully the bench marks might be established at any one time, at the expiration of a comparatively few years there would be a discrepancy between them and the datum plane. The Pennsylvania Railroad has reviewed its bench marks a number of times owing to these discrepancies due to earth motion. The want of agreement, therefore, between the levels of the Atlantic and Pacific Oceans, unless the bench marks were established by surveys which began and ended at exactly the same period throughout the entire distance, might be due to earth movements between the times of the beginning and the end of the survey.

I would again suggest, as I did at my first letter to this paper, that the United States Geological Survey secure not only the lists of bench marks of all railroads, but the variations that have occurred in these bench marks as shown by repeated surveys. If these are carefully tabulated throughout a century, we may obtain important information in regard to the upward and downward crustal movements across the continent.

Edward H. Williams, jr.

SPECIAL ARTICLES.

THE HORIZONTAL PLANE OF THE SKULL AND THE GENERAL PROBLEM OF THE COMPARISON OF VARIABLE FORMS.

In comparative studies of the skull it is customary to select one transversal plane defined by the axis of symmetry with which it is at right angles and by two points, as the standard plane to which the skull is referred. Some authors have made the selection of the two determining points based on morphological considerations, while others have endeavored to determine the physiological horizontal position, determining the latter by two points which are more or less accurately parallel to the direction of horizontal sight.

When this problem is considered from a purely morphological point of view, it will be recognized that there is no justification in selecting arbitrarily two points and disregarding all others, but that the best method of comparison must be based on the assumption that every point of the skull has equal weight and that the nearest approach of all points must be attempted. In this form the problem is applicable to the comparison of all variable forms.

The most favorable superposition of any two forms will be obtained when the sum of the squares of the distances between all pairs of homologous points becomes a minimum. We will refer the body to a system of rectangular coordinates and call x', y' *and* z' the ordinates of a point of the first body, x'', y'' and z'' the ordinates of the homologous point of the second body. By moving the second body by the amounts u, v and w in the direction of the three ordinates, we can modify the relative positions of homologous points without torsion of the body. Then the sum of the squares of the distances of homologous points

$$\Sigma(x'-x''-u)^2+\Sigma(y'-y''-v)^2+\Sigma(z'-z''-w)^2$$

is to be a minimum. Therefore,

$$\Sigma(x'-x''-u)=0.$$

And

$$u=\Sigma(x'-x''),$$

$$v=\Sigma(y'-y''),$$

$$w=\Sigma(z'-z'').$$

Since we may assume the origin of the first system of ordinates arbitrarily, we may take

$$\Sigma x' = \Sigma y' = \Sigma z' = 0;$$

in other words, we take the geometrical center of gravity of the first body as the origin of our system of ordinates. Then

$$\Sigma x'' = \Sigma y'' = \Sigma z'' = 0;$$

i. e., the two bodies must be so placed that their geometrical centers of gravity coincide.

Provided the two forms are symmetrical, this result gives a complete solution of the problem. If the forms are irregular, the degree of torsion must be determined which will give the best result. In most cases the form in question will be symmetrical in at least one direction, so that torsion in one direction only need be considered. Starting with the geometrical center of gravity as the origin of a system of polar coordinates, we have for any given pair of points the coordinates l' and l'' as distances from the center, and a' and a'' as angles with the zero line. If we give the second system of points the torsion ξ, we find that

$$\Sigma\{l'^2 + l''^2 - 2l'l'' \cos(\xi + a'' - a')\}$$

must be a minimum; or

$$\Sigma l'l'' \sin(\xi + a'' - a') = 0,$$

$$tg\xi = -\frac{\Sigma l'l'' \sin(a'' - a')}{\Sigma l'l'' \cos(a'' - a')}.$$

Theoretically, the problem can, therefore, be solved. By using a limited number of well-selected points a good superposition of the two forms can be made.

Experiments, so far as carried out, indicate that alveolar point, nasion, bregma, lambda, basion and pterion give a good superposition of skulls.

It will be noticed that if this method is pursued the arbitrary element in composite drawings or photographs may be eliminated.

FRANZ BOAS.

XUALA AND GUAXULE.

THE location of two Indian villages, Xuala and Guaxule, mentioned in some form by all of the chronicles of Hernando de Soto's wild and unfortunate expedition (1539–41) through the territory now included in the southern states, are important in determining the route of this Spanish adventurer. If the location of these two villages—especially the first—can be determined with reasonable certainty it will enable us to fix the route of the Adelantado with comparative accuracy from his landing place at Tampa Bay, Florida, until he reached the vicinity of Mauvilla in Alabama.

The widest variation in opinion of the numerous authorities touching upon the subject, relates to the position of Xuala; these views, however, may be classed in two unequal groups, as is evident from the following list: The map of Cornelius Wytfliet in his 'Déscrip. Ptolemaica (1596)' locates this village on the west side of Savannah River near the head. DeLisle's map (1707?) in French's 'Hist. Coll. La.,' though indefinite, places it west of the Savannah. Later authorities locate it as follows: Pickett ('Hist. Alabama,' I., p. 8); C. C. Jones, Jr. ('Hernando de Soto,' p. 13); Cyrus Thomas (5th 'Ann. Rep. Bur. Eth., p. 95); and Theodora Irving ('Hist. Cong. Florida,' II., p. 8), all locate it west of the upper Savannah in Nacooche valley, Habersham County, Georgia, or in that immediate vicinity. Mr. James Mooney (19th 'Ann. Rep. Bur. Eth.,' pt. 1, p. 195) and Woodbury Lowery ('Spanish Settlements within the United States,' p. 230, in the text, but not on the map) locate it in the 'piedmont' region of North Carolina, about the head of Broad river—which would be about Henderson County. Gilmore Shea in his article entitled 'Ancient Florida,' in Justin Winsor's 'Narrative and Critical History of America, II.,' follows, in this part of De Soto's route, the course given by C. C. Jones, Jr. Buckingham Smith on the map in his 'Narrative of De Soto' (Bradford Club Series, V., pl. 5) places Xuala about Habersham County, Georgia, but locates Guaxule to the northwest, apparently about Towns County of the same state, or possibly over the line, in Tennessee. Although Shipp ('De Soto and Florida') does not locate Xuala, he places Guaxule in Bartow County, Georgia, thus agreeing substantially with Pickett, Jones and

Thomas. The 'New International Encyclopedia' follows, in part, Mooney and Lowery, but also differs from them in part.

It will be seen from this list that the general consensus of authorities—all, in fact, but two or three—locate Xuala somewhere in northern Georgia, most of them in Habersham County, while Mooney and Lowery place it in southwestern North Carolina, somewhere in the region of Henderson or Rutherford County. Although the article 'De Soto,' in the 'New International Encyclopedia' apparently follows Mooney in locating Xuala, though it does not mention the name, it differs radically from them in regard to the immediately following portion of the route, carrying it down the Coosa, instead of the Chattahoochee. It is rather strange that Lowery on the 'Sketch Map' of his work locates Xuala in or near Habersham County, northeastern Georgia, and Guaxule about Bartow County, and follows down the Coosa River instead of the Chattahoochee as in his text (p. 230).

The object at present is to examine briefly the data and determine, if possible, which of these two divergent views agrees most nearly with the original chronicles of the expedition, and the topography of the country, or whether both are erroneous.

All the facts bearing upon this particular inquiry to be drawn from the original chronicles relate to the march from Cofitachiqui—where the Adelantado was so royally entertained by the noted cacica—to Chiaha, where he paused to recuperate because of abundant food and pasture.

It is now generally conceded that Cofitachiqui was located on the east bank of Savannah River, at or near Silver Bluff, about twenty-five miles below Augusta, though one or two authors have contended that it was at the junction of Broad and Savannah Rivers. We shall, therefore, proceed upon the assumption that it was at or in the vicinity of Silver Bluff—as this theory is maintained by the views we propose to discuss; calling attention first to that theory which places Xuala in western North Carolina.

From Cofitachiqui, according to all the original chronicles, De Soto and his army proceeded northward, without, so far as the records show, recrossing the river, hence on the east side of the Savannah, in what is now South Carolina. However, in order to procure a supply of food the army was divided into two parties, that with De Soto going directly onward, while the other turned aside, some twelve leagues, say the chronicles (probably toward the bottom land), where there was a store of maize offered them by the cacica.

Before reaching Xuala they passed through some small villages or settlements of the Chalaque (or Achalaque) now recognized as the Cherokees. The time given for the march from Cofitachiqui to the Chalaque by the different chroniclers differs considerably; Elvas states it was seven days; Garcilasso, eight; and Ranjel (in Oviedo), only two. Biedma does not mention Chalaque, but makes the time occupied in going from Cofitachiqui to Xuala eight days. As further data regarding the time occupied, it may be stated that Elvas makes the time from Cofitachiqui to Xuala twelve days. Ranjel makes it seven days, mentioning as an intermediate village Guaquili—not noted by the others—which he says was three days' march from Xuala. Garcilasso makes the distance between the same points fifty leagues. All agree in giving the time from Xuala to Guaxule as five days.

As the particular view we are now discussing is that maintained by Mr. Mooney and Mr. Lowery (in his text) and the latter follows the former without going into details, for these we have necessarily to refer to the statements by the former.

According to these the Chalaque villages were probably on or near Keowee River, for which point we may assume Anderson, Anderson County, South Carolina, as among the modern names along the supposed route. From this point the Adelantado's force proceeded to Xuala, which this authority, as already stated, places about Henderson County, North Carolina. From there, according to both authorities, they moved west, 'down French Broad' River as far, we are justified in supposing (as no point is mentioned), as to or near the site of Asheville. From there these authors carry them southwest to

White County, Georgia, where they arrive at Guaxule. This route, if traveled by De Soto as this theory supposes, was according to the geologist of the U. S. Geological Survey, who has been at work in that section, most likely, as follows: Using modern names to designate the points; from Anderson, South Carolina, to Greenville, same state, 26 miles; thence across Blue Ridge to Hendersonville, North Carolina, 35 miles; thence down French Broad valley to Asheville, 22 miles; thence through Hominy Gap and up Richland Creek to Waynesville, 30 miles; thence through Balsam Gap and down Scott's Creek to Webster, 24 miles; thence across Tuckasugee River and Cowee Mountains to Franklin, 17 miles; thence across Nantahala River and down Shooting Creek to Hiwassee, 32 miles; thence up Hiwassee River and down the Chattahoochee to Nacoochee, White County, Georgia, 25 miles, part of this line being along an old Indian trail. As the distance from Silver Bluff to Anderson is about one hundred miles, two or three more or less, this makes the entire distance along this supposed route from Cofitachiqui to Guaxule three hundred and eleven miles, and from Cofitachiqui to Xuala, one hundred and sixty-one miles, and from Xuala to Guaxule one hundred and fifty miles.

Though the route actually traveled according to this theory may not have been precisely that laid down, it must have been near to and parallel with it, and the distance and character of the country were substantially the same.

Our reasons for rejecting this theory are as follows: First, the distance, at least between some of the points, is too great to have been traveled by the army with its incumbrances, among which was a drove of hogs, in the time specified. These hogs may by constantly moving have become good travelers, and may have accomplished the trip from Cofitachiqui to Xuala, a distance of about one hundred and sixty miles, in twelve days—the longest time given by any of the chroniclers. But when the distance from Xuala to Guaxule, which on this route was at least one hundred and fifty miles, has to be traveled in five days, the time given by all the chronicles—a rate of thirty miles per day—the requirement becomes an utter impossibility for an army thus hampered, and scarcely possible for an army free from these incumbrances, especially through a rough and densely wooded country where there were no other roads than narrow pathways.

This route places Xuala on the west or north of the Blue Ridge which has to be crossed in going from Greenville to Hendersonville.

Another insuperable objection to this route is that it requires us to assume that the territory of the cacica extended into western North Carolina, or included a detached section therein with the Sara or Cheraw, a Siouan tribe, as subjects, hedged in between the Cherokees and the Catawbas. This would be extraordinary.

This assumption is absolutely necessary, if we follow the theory in question, as it is clear, from all the chronicles, that Xuala was under the cacica's control. It is even stated by one chronicler that after she made her escape, which occurred between Xuala and Guaxule, it was ascertained that she was at the former village where she and the negro Robles, who escaped at the same time, were living as husband and wife. The assumption of this route requires not only the supposition that the Cheraws were her subjects and their country in her kingdom, but also when she escaped she went back northward into western North Carolina instead of continuing southward to her own proper capital. It also necessitates the supposition that her flight was mostly through Cherokee country, where she would more likely have been taken captive and possibly slain than kindly concealed and helped on her way.

Another reason for rejecting this theory is that it places Guaxule in White County, Georgia, where no mound of the character described is known to exist or to have existed. It is claimed by advocates of the theory that there is a mound which will answer the description near Clarksville. This, however, is a mistake. There is, it is true, a mound in that locality, but it will by no means fill the requirements. It is in the upper part of Nacoochee valley, near its western extremity,

and it is only about, or a little over, twenty feet high, elliptical in form and flat on top. Its base diameters are 190 and 150 feet and its top diameters 90 and 60 feet. There are no evidences of terraces or a graded way; the sides slope gradually from the summit. It has been plowed over for many years, but this would not have effaced entirely a terrace or graded way had there been one. Moreover, there were no such indications extant half a century ago. There is, however, a mound in Bartow County, Georgia, which does fully meet the requirements of the chroniclers' descriptions.

Another reason for rejecting this route is that it follows down the Chattahoochee River instead of the Coosa; in other words, eliminates the 'Coza' for which the Adelantado was in search, and which his successors endeavored to reach. Hamlet is taken out of the play unless the name 'Coza' is transferred to Chattahoochee.

Another reason for considering this theory erroneous is that although the army must have passed through Cherokee territory after leaving Xuala, if this route was followed, no mention whatever of this fact is made by any of the chronicles.

Finally the theory is erroneous because it is based on a mistake. It is apparent, from the statement of the author we have been referring to, that the conclusion reached by others, that Xuala was in northeastern Georgia, was set aside because he had ascertained, as he believed, that there was formerly a tribe of Indians named Suali or Suala in western North Carolina; hence as Xuala might be pronounced Shuala, the two must be one and the same people, in fact he says (Nineteenth Annual Rep. Bureau of Eth., Pt. 195): "As the province of Chalaque is the country of the Cherokee, so the province of Xuala is the country of the Suali or Sara Indians, better known as the Cheraws."

On this slender foundation of a slight resemblance in names does the theory appear to be built, which takes De Soto and his army, with their hogs and other incumbrances, into the 'piedmont region of North Carolina.'

The objection, however, does not stop here, for the statement that there was an Indian tribe in southwestern North Carolina known as Suali or Suala appears to be based solely on the name as used by John Lederer in his 'Discoveries in Three Several Marches' (1672). But it has been shown (*American Anthropologist*, N. S., Vol. 5, No. 4, 1903) that his reputed expedition into Carolina is clearly a fiction, that he was never nearer this point than along the southern border of Virginia, his statements in regard to this section are, therefore, unreliable. What few facts he mentions being obtained, in all probability, from the Indians along Roanoke River, and from the accounts of other earlier explorers, with which he seems to have been familiar.

His name Suali or Suala seems to refer to De Soto's Xuala, of which he appears to have obtained knowledge; in fact, he states that it was obtained from the Spanish. As he knew it was somewhere in the direction of his imaginary journey without any knowledge as to distance, he uses the name to give weight to his fictitious narrative. Distance would have troubled a writer but little who definitely placed a great lake in western North Carolina and believed that the Pacific laved the western slope of the Alleghanies.

Unfortunately, however, for the theory, Lederer nowhere applies the name to the Indians, but throughout expressly limits it to mountains, giving the name Sara to the Indians. The theory, therefore, as given is absolutely without a foundation stone, as the name Suali or Suala was never applied to Indians so far as we are able to ascertain until Mr. Mooney so used it in his 'Siouan Tribes of the East.'

Believing the foregoing reasons to be entirely sufficient for rejecting the theory that Xuala was in the 'piedmont region of North Carolina,' we next proceed to give our reasons for believing that this village or province was located in northeastern Georgia, and Guaxule in northwestern Georgia, most likely in Bartow County.

In attempting to trace that portion of De Soto's route now under discussion it is best to accept what seems to be the most satisfactory evidence in regard to one particular locality mentioned. One item is given by Gar-

cilasso in respect to Guaxule that appears to fix this town, beyond any reasonable doubt, at the mound group near Cartersville, Bartow County, Georgia. The statement of this author is as follows: "La casa estava en un cerro alto, como de otras semejantes hemas dicho. Tenio toda ella el derredor un paseadero que podian pasearse por el seis hombres juntos." "The house [of the chief] stood on a high hill [mound] similar to others we have already mentioned. It had round about it a roadway on which six men might march abreast."

The 'similar to others we have already mentioned' is evidently intended to signify it was artificial, and this is admitted by all who allude to it. The statement that it was 'high' signifies more, in the eyes of the Spaniards, than an ordinary elevation. The large mound of the Etowah group near Cartersville, Bartow County, Georgia, is 66 feet high with base diameters of 380 and 330 feet, and top diameters about 160 and 180 feet. Running up the south side is a broad roadway varying in width from 37 to 56 feet. In bulk it is next in size to the great Cahokia mound near St. Louis. Here then we have a mound which will completely satisfy the description, and the only one in all that section of the south—as is now positively known—which will do so. Moreover, it is sufficiently near Canasauga River to agree with the narrative. There is no reason, therefore, except to maintain a theory, why this should not be accepted as the site of Guaxule. Assuming this as one fixed point, the possibilities of the position of Xuala become much more limited than without this determination.

As the suggestion above mentioned, that the Chalaque villages were near the Keowee River, may be accepted as probably correct, it is apparent from the limited time of the march from Xuala to Guaxule—five days—that we must place the former town somewhere in northeastern Georgia, probably in White or Hall County or in that section. A statement by Biedma appears to have a decided bearing on this question; it is as follows:

> Again we took the direction of the north, and for eight days we traveled through a poor country, scarce of food, until arriving at one called Xuala, where we still found some Indian houses, though a sparse population, for the country was broken. Among these ridges we discovered the source of the great river by which way we started, and which we believed to be the Espiritu Santo. We went on to a town called Guasuli, where the inhabitants gave us a number of dogs, and some maize, of which they had but little; whence we traveled four days and we arrived at a pueblo which was called Chiha, which possessed more food; this is situated on an island of this river of the Espiritu Santo, which from its source has large ones (islands).

That they struck the headwaters of Coosa River, which they thought was the Espiritu Santo (Mississippi), and that they followed it down to Chiaha seems evident, for the description of this river by Biedma in the foregoing citations fits no other river in this region than the Coosa.

This supposition is apparently confirmed by the earliest known map of De Soto's route, made before Tristan de Luna started on his expedition, given by Harrisse in his 'Discovery of North America.' In this a river is laid down about the same locality as the Coosa (and Etowah) running westward marked with islands and towns. It is continued westward, however, to the Mississippi and was evidently drawn to correspond with Biedma's statement, regardless of the fact that De Soto and his followers must have learned at length that it did not extend to the Mississippi. This fact, however, was overlooked by the mapmaker.

CYRUS THOMAS,
J. N. B. HEWITT.

BOTANICAL NOTES.

THE STUDY OF PLANT MORPHOLOGY.

NEARLY twenty years ago Professors Arthur, Barnes and Coulter published a useful book on the morphology of plants under the title of 'Handbook of Plant Dissection.' It included suggestions for studies of a dozen representative plants selected from all parts of the vegetable kingdom. These authors finding themselves unable to undertake the rewriting of the book for a new edition delegated the task to a younger man, Professor O. W. Caldwell, who brings it out under the new title 'Handbook of Plant Morphology'

(Holt & Co.). The new book follows the old one in plan, and to a considerable extent in detail also. By abridgment of the suggestions to the student (an improvement over the old book) the author has been able to take up more than twice as many plants, thus enabling the teacher to make a better selection where it is not possible to study all of them. Two things are emphasized in the book, namely, that structures of plants are related and more or less perfectly adapted to the two primary functions of nutrition and reproduction, and that there has been a gradual evolution of plants in the vegetable kingdom. The purpose of this course in plant morphology is to give the pupil broader views of plants and their structure, and in this the author has succeeded very well. The book should find place in the better class of high schools.

There is only one serious criticism to be made on the book, and that is that in the glossary the suggestions as to the original meanings of the terms (given in parentheses) are often very misleading. In another edition these suggestions should be wholly omitted, or the roots from which the terms are derived should be inserted, as was done in the old book.

PLANTS OF THE BAHAMA ISLANDS.

THE vegetation of the Bahama Islands is lucidly sketched and discussed by Professor Doctor W. C. Coker in a recent paper published by the Geographical Society of Baltimore. A short history of the botanical explorations of the islands is given, followed by discussions of the composition and relationships and distribution of the Bahama flora. Annotated lists are given of the plants of economic importance, including trees and shrubs useful for their woods or leaves (20 species); medicinal plants (6 species); indigenous fruits (10 species); cultivated fruits (25 species); ornamental trees (10 species). Twenty-five to thirty pages are given to an ecological discussion of the vegetation on the different islands, followed by a systematic list of all the species collected, beginning with slime molds (11 species), and including algae (50 species), fungi (22 species), lichens (40 species), mosses and liverworts (16 species), ferns (14 species) and flowering plants (423 species)—in all 580 species. Sixteen full-page plates, including half-tone reproductions of thirty-one fine photographs, complete this instructive paper.

RECENT BOTANICAL PAPERS.

PROFESSOR DOCTOR ARTHUR finds (Bull. 103, Indiana Expt. Station) that smut may be destroyed in seed oats by the simple operation of sprinkling the seed with a solution of formalin of a strength of one pound of the formalin to fifty gallons of water, using enough water to make the oats moist enough 'to pack in the hand.' It is then to be shoveled into a pile and covered for two hours, when it is ready for sowing. If preferred it may be spread out and dried before sowing.—C. L. Shear discusses the fungous diseases of the cranberry (Farmers' Bull. 221, U. S. Dept. Agr.), namely, 'blast,' 'scald,' 'rot' and 'anthracnose.' It is shown that these diseases may be controlled by a proper application of Bordeaux mixture.—'The Shade Trees of Denver' (Bull. 96, Colorado Expt. Station), by Professors Paddock and Longyear, possesses more than local interest in that it records all the trees not natives of Colorado which are known to be growing in Denver. When it is remembered that the elevation of the city above sea level is exactly one mile, it is evident that the conditions are very different from those where these exotic trees originated. The growing of trees under such conditions becomes an interesting experiment in the acclimatization of plants.—The latest 'Contribution' from the Gray Herbarium of Harvard University (No. XXIX.) includes descriptions of new species of plants from the islands of Margarita and Coche, Venezuela, by Dr. B. L. Robinson. The announcement is made that Dr. Robinson has in preparation a flora of the islands.—The second part of Professor Gifford Pinchot's 'Primer of Forestry' has recently appeared as Part II. of Bull. 24 of the United States Bureau of Forestry. This part deals with the practise of forestry, with work in the woods, and with the relation of the forest to the weather and the streams, and concludes

with a short account of forestry at home and abroad. It is beautifully illustrated with half-tone reproductions of photographs. It will be very helpful to forestry students.

CHARLES E. BESSEY.

THE UNIVERSITY OF NEBRASKA.

THE HARVEY SOCIETY OF NEW YORK CITY.

A NEW society called the Harvey Society, consisting of laboratory workers in New York City, has recently been established under the patronage of the New York Academy of Medicine. Its purpose is the diffusion of scientific knowledge in selected chapters of anatomy, physiology, bacteriology, pathology, pharmacology and physiological and pathological chemistry, by means of public lecures by men who are workers in the subjects presented.

Each lecture is intended to represent the state of modern knowledge concerning the topic treated and at the same time will be adapted for presentation before an audience consisting of that portion of the general medical profession who are interested in the scientific side of medicine.

It is hoped that through these lectures the common interests of research workers and the medical profession may be profitably cultivated. The fulfilment of the purposes of the society has been entrusted to the hands of the following committee:

Graham Lusk, *president*,
Simon Flexner, *vice-president*,
George B. Wallace, *secretary*,
Frederic S. Lee, *treasurer*,
Christian A. Herter,
S. J. Meltzer,
E. K. Dunham.

The members of the society consist of two classes, active and associate members. Active members are laboratory workers in the medical sciences residing in New York. Associate members are such persons as may be in sympathy with the objects of the society and reside in New York.

The first course of lectures will be given on Saturday evenings during the winter of the years 1905–1906 at the Academy of Medicine.

SCIENTIFIC NOTES AND NEWS.

THE Royal Society elected, on May 11, the following new fellows: John George Adami, professor of pathology, Montreal; William Arthur Bone, lecturer on chemistry, Manchester; John Edward Campbell, mathematical lecturer, Oxford; William Henry Dines, meteorologist, London; Captain Arthur Mostyn Field, R.N., hydrographer of the Navy, London; Martin Onslow Forster, assistant professor of chemistry, Royal College of Science, London; Edwin S. Goodrich, demonstrator of anatomy, Oxford; Frederick Gowland Hopkins, reader in chemical physiology, Cambridge; George William Lamplugh, district geologist on the Geological Survey, Ireland; Ernest William MacBride, professor of zoology, Montreal; Francis Wall Oliver, professor of botany, University College, London; Lieutenant-Colonel David Prain, I.M.S., superintendent of Royal Botanic Gardens, Calcutta; George F. C. Searle, senior demonstrator in Cavendish Laboratory, Cambridge; Hon. Robert John Strutt, fellow of Trinity College, Cambridge; Edmund Taylor Whittaker, mathematical lecturer of Trinity College, Cambridge.

DR. FRANZ BOAS has resigned from the curatorship of the anthropological department of the American Museum of Natural History. He will continue his connection with the museum, conducting the researches and publications of the Jesup North Pacific Expedition and of the East Asiatic Committee.

DR. ALLAN MCLAUGHLIN has been appointed head surgeon of the Marine Hospital at Naples, in the service of the United States.

PROFESSOR JAMES H. TUFTS, of the University of Chicago, was elected president of the Western Philosophical Association at the meeting held at the University of Nebraska on April 21 and 22.

SIR WILLAIM DE W. ABNEY, K.C.B., Mr. Shelford Bidwell, Lord Alverstone, Dr. Ludwig Mond, Lord Rosse, Sir Thomas H. Sanderson, Sir James Crichton-Browne (treasurer), and Sir William Crookes (hon. secretary), have been nominated as vice-presidents of the Royal Institution, London.

The Jacksonian prize of the Royal College of Surgeons of England has been presented to Mr. Herbert J. Paterson.

The Hanbury gold medal of the Pharmaceutical Society, London, has this year been awarded to Professor Ernst Schmidt, professor of pharmaceutical chemistry in the University of Marburg.

Dr. William Welch, professor of pathology at the Johns Hopkins University, sailed for England on May 27, to be absent until September.

Dr. Ernest W. Brown, professor of mathematics, Haverford College, will be a member of the official party of the British Association for the South African meeting. He will be absent from Haverford from June 15 to October 30.

Mr. A. Pitts Morse, of the zoological department of Wellesley College, will this summer continue his researches on the North American Acridiidae. He will make a collecting tour through Alabama, Mississippi and Louisiana.

Robert Kennedy Duncan, professor of chemistry in Washington and Jefferson College, has been granted a year's leave of absence in order to accept a commission from *Harper's Magazine* to spend a year in Europe in the study of the relations of chemistry to industry. Dr. Ralph Garrigue Wright will act as substitute during his absence.

Professor Hecker, who has been making observations for gravity in the Indian and Pacific oceans and at various coast stations, under the auspices of the International Geodetic Association, returned to Berlin about the middle of April. It is reported that satisfactory observations were obtained by him.

The degree of doctor of science in botany has been conferred by the University of London on Miss Agnes Robertson for a thesis entitled 'Studies in the Morphology of *Torreya Californica*, Torrey,' and other papers.

At a meeting of the Royal Geographical Society held on May 16 a paper, entitled 'Exploration and Survey with the Tibet Frontier Commission, and from Gyangtse to Simla *via* Gar-tok,' was read by Major C. H. D. Ryder, R.E. Major Ryder was the officer in charge of the survey work carried out in connection with the British Mission to Lhasa, and for his services to geographical science has this year been awarded one of the society's highest honors, the patron's gold medal.

A portrait of Dr. Thomas Young has been presented to the Royal Institution, London, by Mrs. Barton.

Sir Bernhard Samuelson, F.R.S., an iron manufacturer who was interested in technical education, died on May 10, in his eighty-fifth year.

Lieutenant-Colonel L. H. L. Irby, a British ornithologist, has died at the age of sixty-nine years.

There will be a civil service examination, on June 21, for the position of assistant in the Office of Seed and Plant Introduction, Department of Agriculture, at a salary of $1,800.

Governor Higgins has signed the bill incorporating the Staten Island Association of Arts and Sciences, which thus becomes the successor to the Natural Science Association of Staten Island. The act authorizes the city to provide accommodation for the association in the new borough hall temporarily, to erect suitable buildings for a public library and museum and to contribute $10,000 annually for maintenance.

The California legislature has made an appropriation providing for the establishment of a laboratory and experimental station for the study of plant diseases in Southern California, the station to be conducted under the auspices of the Department of Agriculture of the University of California.

Arrangements are now almost complete for the opening of a marine biological station at La Jolla, a suburb of San Diego, Cal., under the direction of Professor William E. Ritter, of the University of California. The laboratory will take the place of the one that has been conducted by Professor Ritter during the past year or two at Coronado Beach.

THE Biological Laboratory of the Bureau of Fisheries at Woods Hole, Mass., will open for the current season on or about June 15. Opportunities for research in the field of marine biology will, as usual, be furnished to a limited number of qualified investigators. Candidates for tables should send applications at an early date to the commissioner of fisheries, Washington, D. C., or to the director of the laboratory, Dr. F. B. Sumner, College of the City of New York, New York, N. Y. Applications from those who are not already known at the station should be accompanied by proper endorsements.

THE Georgian Bay Biological Station will be open from June 5 to September 5. The station is a summer laboratory, established in 1901 by the Dominion government in connection with the Department of Marine and Fisheries, for the investigation of problems in lacustrine biology. It is located at Go Home Bay, a small offshoot of the Georgian Bay, distant about twenty miles from the towns of Midland and Penetanguishene, and on the course of the Northern Navigation Company's steamboat line connecting Penetanguishene and Parry Sound. There is no charge to those wishing to work in the laboratory.

IT is said that Mr. William Ziegler, who died on May 24, has provided in his will for the continuation of his Arctic explorations. It will be remembered that Mr. Anthony Fiala is now in the Arctic regions under Mr. Ziegler's auspices. He has not been heard from for two years, and two relief expeditions have now been sent.

THE American Mathematical Society will hold its twelfth summer meeting at Williams College, Williamstown, Mass., on September 7 and 8.

THE German Mathematical Society will hold its annual meeting at Meran, Tyrol, from September 24 to 30, under the presidency of Professor P. Stäckel, of the University at Kiel.

IN the spring of this year the International Geodetic Association set aside 80,000 Marks for the purpose of extending variation of latitude observations to the southern hemisphere. The plans of the association are making good progress, and it is expected that the astronomers who will carry on the work will reach the points selected in November of this year. One of the observatories will be established near Cordova, Argentine Confederation, and the other near Perth, in Australia.

IT was stated in the issue of SCIENCE, for April 21, that the New Mexico legislature had appropriated $6,000 for a State Geological Survey to be spent under the direction of the New Mexican School of Mines at Socorro. We are informed that the only reference to such a survey occurs in the general appropriation bill and is as follows: 'For publication U. S. geological survey reports to be expended under the direction of the Socorro School of Mines, or so much thereof as may be necessary, $2,500.'

A REUTER telegram from Berlin says that in the course of excavations in the neighborhood of Breslau 400 graves and 150 prehistoric dwelling places have been brought to light. The oldest of the graves contained bones dating from a period previous to the Bronze Age, and in another grave near by were found urns showing that they had contained bodies interred five centuries later. The excavators have been able to trace the site of a village of the bronze age. About a dozen huts are clearly recognizable. A whole collection of spinning and weaving appliances has also been dug up.

CONSUL-GENERAL RICHARD GUENTHER, of Frankfort, reports that the Associazione degli Industriali d' Italia, No. 61 Foro Bonaparte, Milan, Italy, invites inventors to compete for two prizes offered by it, as follows: First prize, $1,600 and a gold medal, for a new method to prevent danger which may arise from the contact of high tension with low tension wrapping at electric rotary-current transformers; second prize, $100 and a gold medal for a simple, strong, and reliable safety device for stopping cars running on an inclined plane in case of the breaking of the wire cable. The device must be capable of adjustment to the ordinary cable roads now in use.

The Adams prize for 1906 is offered for an essay on 'The Inequalities of the Moon's Motion Due to the Direct Action of the Planets.' The prize, which is of the value of £225, is open to the competition of all persons who have at any time been admitted to a degree in the University of Cambridge.

The Bureau of Forestry has published a circular giving information regarding employment on the national forest reserves. This circular explains how appointments to the Forest Service on the reserves are made, states the salaries of its members and indicates the knowledge and experience required of rangers and supervisors and the duties each must perform. The future organization will include forest supervisors at $1,800 to $2,500 a year, deputy forest supervisors at $1,500 to $1,700, forest rangers at $1,200 to $1,400, deputy forest rangers at $1,000 to $1,100 and assistant forest rangers at $800 to $900. The law requires that every applicant for a position in the Forest Service pass a civil service examination. Legal residence in the state or territory in which employment is desired is generally necessary, since only where examinations fail to secure thoroughly satisfactory men are vacancies filled by the examination of applicants from other states. Appointments of supervisors are made, so far as practicable, by promotion of competent rangers or forest assistants. To be eligible as forest ranger the applicant must be physically sound, accustomed to outdoor work, and know how to take care of himself and his horse in regions remote from settlement and supplies. He must know something of surveying, estimating and scaling timber, lumbering and the livestock business. Some of the reserves require a specialist in one or more of these lines of work. The applicant must be thoroughly familiar with the region in which he seeks employment. The entire time of rangers is to be given to the service. Rangers, under the direction of the forest supervisor, patrol to prevent fire and trespass; estimate, survey and mark timber and supervise its cutting; issue mining permits, build cabins and trails, enforce grazing restrictions, investigate claims and make arrests for violation of reserve laws. Forest supervisors must have all the qualifications of rangers, combined with superior business and administrative ability. They deal with the public in all matters connected with the sale of timber, the control of grazing, the issuing of permits and the application of all regulations for the use and occupancy of forest reserves. Knowledge of technical forestry is desirable, but not essential.

UNIVERSITY AND EDUCATIONAL NEWS.

It is announced that Harvard University has received an anonymous gift of $100,000 for a museum of social ethics, and $50,000 from Mr. Jacob H. Schiff, of New York, for explorations in Palestine.

The Ontario government has announced a provisional grant of $500,000 to the University of Toronto towards the proposed new buildings which, it is estimated, will cost $1,600,000.

The Drapers' Company has agreed to give £5,000 for a building for the department of agriculture at Cambridge, provided that an equal sum be raised by voluntary contribution.

A. S. Mackenzie, A.B. (Dalhousie), Ph.D. (Johns Hopkins), professor of physics in Bryn Mawr College, has been appointed to the chair of physics in Dalhousie College.

Dr. J. E. Duerden, of the University of Michigan, formerly curator of the museum, Jamaica, has been appointed professor of zoology, at the Rhodes University College, Grahamstown, Cape Colony, South Africa.

Mr. L. R. Waldron, assistant professor in the department of botany and zoology of the North Dakota Agricultural College has lately resigned to accept a position of superintendent of the Sub-Experiment Station located at Dickinson. Mr. W. B. Bell of the University of Iowa has been elected to fill the vacancy.

Austin Flint Rogers, A.B. (Kansas), Ph.D. (Columbia), tutor in mineralogy in Columbia University, has been appointed assistant professor of mineralogy and petrography in Stanford University.

The Board of Trinity College, Dublin, has founded a chair of education, and Mr. Edward P. Culverwell, fellow of Trinity College, has been elected to the professorship.